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BASELINE

FIRE PROTECTION FACILITY ASSESSMENT

FOR

BUILDING 9203 AND 9203A COMPLEX

AT

Y-12 PLANT, OAK RIDGE, TENNESSEE

MARCH 1993

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PREPARED FOR

DEPARTMENT OF ENERGY

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BASELINE

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FOR

BUILDING 9203 AND 9203A COMPLEX

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EDITOR'S NOTE

This document was prepared under the requirements of DOE Order 5480.7A which was in effect during the preparation and review cycle. It is intended to represent a typical Fire Protection Assessment for a moderate nuclear facility. DOE Order 5480.7A has subsequently been replaced by DOE Orders 420 and 440.1 as well as Implementation Guide G-420/440.1. These documents contain requirements and guidance for Fire Protection Assessments similar to those in DOE Order 5480.7A.

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1.0 INTRODUCTION

1.1 Purpose and Approach

This assessment is intended to evaluate the fire hazards, life safety and fire protection features inherent in the Building 9203 and 9203A complex.

The assessment approach included a review of the fire protection records and drawings of the Building 9203 and 9203A complex, several field walk downs of the building, identification of known fire hazards and previous deficiencies, and a field review of the life safety and fire protection features of the building.

1.2 Facility, Use, Function, and Occupancy

Buildings 9203 and 9203A were recently designated as the Manufacturing Technology Deployment Center for the Y-12 Plant. The facilities in these buildings are intended to be used for technology transfer between the Y-12 Plant and the commercial manufacturing community. Numerous complex materials development and testing capabilities currently exist at the Y-12 Plant, that could be transferred to the commercial sector to allow competitiveness and more effective use of resources. The Center has therefore been established to provide this link to private industry. The equipment and facilities located in Buildings 9203 and 9203A include various types of computer equipment that can be networked to mainframe computers. The buildings, originally constructed over 30 years ago, have 50,000 square feet of floor area, that include analytical laboratories, manufacturing demonstration laboratories, fabrication shops, chemical process pilot laboratories, ultrasonic testing laboratories, stress and fracture testing laboratories, electronics and instrumentation laboratories, and surface chemistry and physical properties laboratories which use several types of electron microscopes. A 274 person conference room and a large assembly area are provided for public presentations. The facility also includes office areas for resident specialists.

Due to the complex arrangement of these buildings, a single occupancy classification cannot be assigned. An area by area classification is therefore used. The classifications are based upon the Life Safety Code and the Uniform Building Code (UBC), current editions.

Building 9723-24 - This building is considered an Existing Business occupancy by NFPA 101, and is classified as a UBC B-2 occupancy. The building also includes an Existing Class "C" Assembly occupancy having 2,800 square feet, which is also classified as UBC A-3.

Building 9203A - The first floor is considered General Purpose Industrial occupancy, and the second floor is considered an Existing Business occupancy by NFPA 101. Both are classified as UBC B-2 occupancy.

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Building 9203 - The majority of the building is considered a General Purpose Industrial occupancy by NFPA 101. The second floor conference room is an NFPA 101 Class "C" Assembly occupancy of 2,850 square feet. Several offices are located in building 9203, however, these offices are considered incidental to the laboratories, and are classified with the remainder of the building. The building is classified as UBC B-2 except for the Assembly occupancy, which is classified as UBC A-3.

Building 9752 - This building is classified as a General Purpose Industrial occupancy by NFPA 101, and classified as UBC B-2.

Building 9205 - This building is classified as a High Hazard Industrial occupancy by NFPA 101, and classified as UBC B-2. Note: The building contains less than the exempt amount of hazardous materials listed in the UBC for a fully sprinklered facility. Therefore, the building is not classified as a Group H occupancy.

1.3 General Site Fire Protection

The fire protection for the Y-12 Plant, which is pertinent to the 9203 and 9203A Complex, primarily consists of a site-wide fire alarm system, a fire service main and water supply, and a site fire department. All are adequate for this building. Refer to Reference (a) for further details on plant's fire protection features.

2.0 CONSTRUCTION

2.1 Description of Facility

The Building 9203 and 9203A Complex consists of five different buildings that were constructed at different times using different types of construction. Some of the individual buildings were expanded during their lifetime, resulting in individual composite construction types. The buildings were constructed over 30 years ago. The buildings are all interconnected via corridors or stairways. Because of this, the complex is analyzed as a single facility. Building 9723-24 is the entrance to the complex on First Street. Building 9203A connects to the west side of building 9723-24. Building 9203 connects to the south side of Building 9723-24. Building 9752 is located on the southeast side of Building 9203, and Building 9205 is located on the southwest side of Building 9203. Descriptions of the five building are as follows:

Building 9723-24 - This building is a one story wood frame building with a sloped roof that fronts on First Street. The building construction classification per the Uniform Building Code (UBC) for this structure is Type V, non-rated combustible. The south side of this building adjoins building 9203, while the west side of this building connects to building 9203A. This building contains offices, and two large open areas that are used for public meetings. The gross

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floor area of this building is approximately 9,000 square feet.

Building 9203A - This building is an unprotected steel frame, and concrete block, two story structure. The roof is a flat gravel covered built-up membrane over a steel deck. This is considered to be non-rated, noncombustible UBC Type II-N construction. Building 9203A connects to building 9723-24, through a corridor adjacent to the south stairwell. Two hour fire rated concrete block walls and fire rated doors for Class B openings perform this separation. The south stairwell of Building 9203A is connected to building 9203 via the Vacuum Technology Laboratory on the first floor, and the large conference room on the second floor. The gross floor area of building 9203A is approximately 6,000 square feet per floor. An additional area of approximately 625 square feet exists only on the first floor of building 9203A. This area was added to the northeast wall on the front side of the building and is used to house the ultrasonic test equipment.

Building 9203 - This building is for the most part, a one story structure located south of building 9723-24. A three story tower is located on the south side of the building between column lines 9.5 and 12. The second and third floors of this tower area are unoccupied and are restricted contaminated radioactive areas. The east side of the building is constructed of heavy reinforced concrete columns and floor slabs. Walls between the columns are filled in with hollow clay tiles between column lines 7 and 12, and bricks between columns 4 and 7. A flat built-up membrane roof is provided. From column line 4 to the west end of the building, the construction is concrete block and unprotected steel frame. This is considered non-rated, noncombustible UBC Type II-N construction. The gross floor area of this building is approximately 24,300 square feet.

Building 9752 - This building is located in the southeast corner of building 9203, and is accessed from building 9203 through the small machine shop in room 30. The building includes three rooms. Room 33 is the machine equipment room, which is a separate room accessible only from the outside. Room 30, the small machine shop, and room 31, the electrical maintenance shop are the remainder of the building. The construction of this building is consistent with the adjacent section of building 9203, which consists of reinforced concrete frame and walls of hollow clay tile. This is considered non-rated, noncombustible construction UBC Type II-N. The gross floor area of this building is approximately 1,320 square feet.

Building 9205 - This building is located next to the southwest corner of building 9203 and can only be accessed from exterior doors. The west section of the building is a reinforced concrete frame building with hollow clay tile walls. The west side of the building consists of a large central laboratory room, and the east side is a small connected workshop. The workshop section is constructed with concrete block walls. A flat built-up roof having concrete construction is provided. A noncombustible gas cylinder storage area is located on the exterior north side of the building. This is considered non-rated, noncombustible construction UBC Type II-N. The gross floor area of this building is approximately 2,700 square feet.

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2.2 Fire Boundaries

Fire separations are provided between buildings within the Building 9203 and 9203A Complex. A two hour fire rated concrete block wall with rated fire doors for Class B openings separates building 9203A and building 9723-24. The stairways on each end of the large conference room and in the northeast corner of building 9203A are also constructed of concrete block walls and Class B fire doors. The wall between building 9723-24 and building 9203, which is the north wall of the Vacuum Technology Laboratory is a two hour fire rated concrete block assembly. The south wall of the Vacuum Technology laboratory is also a two hour rated concrete block assembly. Finally, the wall between building 9203 and building 9752 is a two hour fire rated assembly. This wall is a hollow tile assembly.

In the March, 1993 FHA for this complex, deficiencies were noted with many of the fire barriers in the complex. The fire area boundaries in this facility are considered inadequate to meet the criteria of DOE Order 5480.7A. A deficiency was documented in the FHA for the lack of a comprehensive fire barrier control program.

3.0 LIFE SAFETY

3.1 Means of Egress

Each of the sections of the Building 9203 and 9203A Complex have slightly different exit arrangements. To simplify the analysis of the exit system, each building is discussed separately.

Building 9723-24 - This building is currently served by five direct exit doors. Two exit doors are located on the north side of the building. Both of these exits have double doors. A single door is located on the south side, and another single door is on the east side of the building. In addition to these direct exit doors, the rear corridor of Building 9723-24 interconnects to the Building 9203 corridor on the east side of the Vacuum Technology Laboratory. A direct exit door is located in this corridor about fifteen feet from building 9723-24. The rear corridor of Building 9723-24 also provides access to Building 9203A through the rear exit lobby from that building. Both of these openings to the other building are made via short ramps to match the different floor elevations. The maximum slope is 1 in 9 for a ramp 9 feet in length. The exit capacity of the five direct exits is 1,140 persons. The calculated occupant load for the building is 113 persons, based upon an allowance of 100 square feet per person as specified by the Life Safety Code for an Existing Business Occupancy. In the Business Occupancy sections of the building, the number of occupants is normally less than 10. During special events, the large room in the front of the first floor of the building is used as a public meeting room, which is considered a Class "C" Assembly Occupancy. The meeting room is a large open room that is filled with folding chairs during an event. The area of this room is approximately 2,800 square feet. Using

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an occupant load factor of 15 net square feet per person for this area will add an additional 187 persons to the overall calculated load for the building, for a total of 300 persons. The exit capacity of 1,140 persons is well in excess of that required. The remote exits are separated by a straight line distance of 73 feet. The overall diagonal of Building 9723-24 is 158 feet. The exit remoteness therefore satisfies the 1/3 diagonal criteria for a sprinkler protected building in accordance with NFPA 101.

One deficiency was identified in this building. The corridor that leads from the first floor large Assembly area in building 9723-24 to the rear exit corridor is separated from the corridor by a set of double doors adjacent to the rest rooms. These exit doors swing against the direction of exit travel from the Assembly area. The direction of swing on these doors should be reversed to swing with the marked direction of travel .

Other than the identified deficiency, the means of egress for this building provides multiple, remotely located exit paths that have adequate capacity and remoteness to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

Building 9203A - This building is served by two concrete block stairway enclosures located on the northwest and southeast sides of the building. The stairway doors are labeled self- closing fire door assemblies for Class B openings. The stairways both have a clear width of 46 inches, providing an exit capacity for 306 persons. The calculated occupant load for this building is 77 persons, based upon an occupant load factor of 100 persons per square feet for a Business or Industrial occupancy. The capacity of the two stairways is more than adequate. The normal number of occupants in the building is approximately 25 people. The stairways are separated by a straight line distance of 85 feet. The overall building diagonal is 125 feet, therefore the exit remoteness satisfies the NFPA 101 1/3 diagonal criteria for a sprinkler protected building. Both stairways discharge directly to the outside. The first floor occupants also have the option of using two direct exit doors located next to the stairway enclosures. There were no concerns identified with the exit provisions of this building. A dead end corridor was noted on the second floor along column line 15 by the copy machine. The measured length of the corridor is approximately 40 feet, which is acceptable per NFPA 101. The means of egress for this building provide multiple, remotely located exit paths that have adequate capacity and remoteness to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

Building 9203 - This building has six direct exit doors. The north exit door is a double door located in the corridor between building 9723-24 east of the Vacuum Technology Laboratory. This corridor has a set of double doors to the outside approximately fifteen feet from building 9203. The west side exit door is a single door, accessed through laboratory room 49 (X-ray lab at Col. G). The east side door is a double door accessed through a general area designated as room 26 (between Cols. E & F). The central corridor at Column line C connects to three north-south corridors (at Cols 4, 7,& 9.5) that provide a means of egress to the south loading dock. Each of

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these corridors has a set of double doors to the exterior. The capacity of the exit doors is 1,600 persons. The calculated occupant load of the building is 243 persons, based on an occupant load factor of 100 square feet per person. The capacity of the exits is therefore considered acceptable. The normal number of occupants in the industrial sections of the building is approximately 25. The remote exits are separated by a straight line distance of 150 feet. The overall building diagonal is 212 feet. The exit remoteness is therefore considered acceptable. There were no concerns identified with the exit provisions of this building. The second and third floor areas on the east side of the building are accessed via a single stairway at column line H-7. Because these restricted areas are vacant, the single exit is considered acceptable. The means of egress for this building provide multiple, remotely located exit paths that have adequate capacity and remoteness to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

The Vacuum Technology Laboratory and the second floor large conference room are part of this building, however, due to their semi-detached location, the exit provisions for these areas are considered separately. The Vacuum Technology Laboratory primary exit is through a set of double doors on the east side that open into the corridor between buildings 9203 and 9723-24. A direct exit door is provided in the corridor, directly across from the doors to the Vacuum Technology Laboratory. The second means of egress is provided by a direct exit door to the outside on the west side of the laboratory. A third door is provided that opens to the first floor landing of the south stairway of building 9203A. The large conference room on the second floor uses the south stairway of building 9203A as its primary exit path. A second stairway is located at the rear of the conference room. The rear stairway discharges to the first floor corridor by the main entrance to the Vacuum Technology Laboratory. Per NFPA 101, up to 50% of the required means of egress do not have to discharge to the outside, but are permitted to discharge on the level of exit discharge in a sprinklered building. The conference room is approximately 2,850 square feet. Using an occupant load factor of one person per 15 net square feet provides a calculated occupant load for this area of 190 persons. The south stair of building 9203A has a capacity of 153 persons. The rear stair in the conference room has a minimum capacity of 146 persons. The available exit capacity is therefore 299 persons. Because this must be shared with building 9203A, a percentage of the occupants from building 9203A must be assumed to use the south stair. For conservatism, the entire calculated occupant load (77 persons) is assumed to use this stairway. This would still allow an exit capacity of 222 persons, which exceeds the calculated load for the conference room. The means of egress for this building provide multiple, remotely located exit paths that have adequate capacity and remoteness to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

Building 9752 - This building has three exits doors. The machine equipment room has a single exit door located on the east side of the building. This exit serves only this room. The electrical maintenance shop, room 31, has a set of double doors to the loading dock on the south side of the building. Room 31 also has a single exit door that leads to the small machine shop. A west exit door serves the small machine shop, room 30. The calculated occupant load for this building

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is twelve persons, based upon an occupant load factor of 100 square feet per person. The number of persons normally in the building is less than 10 persons. The exit doors have a capacity of 775 persons, therefore the exit capacity is considered adequate. There were no concerns identified with the exit provisions of this building. The Life Safety Code permits a single exit for areas having common path of travel of 50 feet. Travel distance in all the rooms in this building is 35 feet or less. The means of egress for this building provide exit paths that have adequate capacity to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

Building 9205 - This building is served by four direct exit doors. One is located on the east side of the building near the acid storage shed, two are located on the north side of the building, and the last door is located on the south side of the building. The capacity of the exit doors is 700 persons. The calculated occupant load for the building is 27 persons, based upon an occupant load factor of 100 square feet per person. The normal number of occupants in the building is less than 15 persons. Therefore, the exit capacity is adequate. The remote exits are separated by a straight line distance of 75 feet. The overall building diagonal is 90 feet. Therefore, the exit remoteness is satisfactory for a sprinkler protected building. The means of egress for this building provide multiple, remotely located exit paths that have adequate capacity and remoteness to satisfy NFPA 101, meets the UBC exit requirements, and are adequate for the protection of the building occupants.

The exit provisions in this complex are considered acceptable and in compliance with the criteria of NFPA 101, except for the one identified deficiency.

3.2 Emergency Lighting and Exit Signs

All of the buildings in the complex use battery pack emergency lighting units for the illumination of the primary exit paths. In addition, there is a gasoline powered generator that will come on line if main power is lost. The building electrician reported that there is at least one lighting fixture in each room that is connected to the emergency circuits, except for the second floor of building 9203A. Illuminated exit signs are installed above the exit doors and in the exit corridors. The exit signs are connected to the emergency generator as well. To supplement this, all exit doors and doors leading to an exit are painted red. The provisions for emergency lighting and the locations of the exit signs are adequate and provide a level of protection consistent with the criteria of NFPA 101, and therefore comply with the requirements of DOE Orders.

4.0 FIRE HAZARDS

4.1 Identification of Significant Fire Hazards

The potential fire hazards in the complex are outlined in the following sections. The hazards are addressed on a building by building basis. In general, the occupancies consist of office space,

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laboratories, and General Industrial occupancy. With the exception of building 9205, all of these are considered to be Ordinary hazard in terms of the fire risk present. Quantities of combustibles in these areas are moderate with no stockpiling of combustibles over 8 ft. high. Anticipated rates of heat release are expected to be in the range of 1 MW to 10 MW, except in a few isolated areas. Laboratory usage of compressed gas cylinders of hydrogen and methane in building 9205 presents a potential risk of explosion, thus causing this portion of the complex to be classified as a High Hazard Occupancy. The laboratories use limited amounts of flammables (typically 10 to 20 gallons per laboratory mostly in approved cabinets), which categorizes them as Class C Laboratories.

Building 9723-24 - This building is primarily office space. There is currently a clean room located on the east side of the building. The clean room is no longer in use and is to be removed. The area contains steam pressure equipment and an electric boiler. Other than the electric boiler, there are no significant fire hazards in this building.

Building 9203A, first floor - The ground floor of this building contains an electrical switchgear and HVAC room, an X-ray laboratory in room 104, several electrical testing laboratories in rooms 113, 100, and 102, and an ultrasonic testing laboratory in room 105. The rooms typically have entrance doors with a large glass windows and a 2-ft X 2-ft louver in their lower half. The X-ray lab has several oil filled dielectric power supplies (less than 25 gallons of oil) and several cable trays. Thorium is stored in a safe in room 113. The quantity of thorium is less than 25 grams. Radioactive sources are stored in a closet in the rear of room 102. A 12 gallon approved flammable liquids cabinet is located in room 103.

Building 9203A, second floor - The second floor of this building is office space. Rooms 212 and 215 are raised floor computer rooms. There are no significant fire hazards in these areas.

Building 9203 - A section of the stress fracture testing lab in room 1 is designated as a radiation controlled area. This is because radioactive samples are sometimes tested in two large hydraulic testing stands located in this area. The hydraulic pump and oil tank that supplies the test stands is located in an exterior mechanical room. The hydraulic system uses approximately 200 gallons of Mobil DTE 25 hydraulic fluid at 2,000 to 3,000 psi with a flow rate of 40 gpm. The high pressure hoses for the hydraulic rams are routed through an opening in the exterior wall. Rooms 7 and 8 are used for surface analysis. Lithium hydride is stored in three glove boxes in room 8. The maximum quantity of the hydride is less than a quart of material. The thermally sensitive material, in a gray crystal form, is contained in inerted (Argon atmosphere) glove boxes. Rooms 13A and 33 are HVAC rooms which contain air handlers and some electrical gear. Room 15 is an air monitoring lab with a radiation control area. Lab quantities of depleted uranium and thorium are stored in this room. Room 17 is an X-ray diffraction laboratory with small amounts of chemicals. Room 19 is a laser laboratory that has a Class IIIB and a Class IV laser. Room 42 is a laboratory that is presently vacant. Rooms 45 through 50 are micro-analysis laboratories with a scanning electron microscope and a transmission electron microscope. Rooms 47 and 49 contain

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small quantities of various laboratory chemicals, while room 47 has small quantity of Lithium Hydride in a glove box. Room 49 also has a 12 gallon approved flammable liquids cabinet. The Vacuum Technology Laboratory located in room 150 has various precision machining tools, heavy duty electrical service outlets, and an approved flammable liquids storage cabinet.

The second and third floor are vacant areas that have been roped off as restricted contaminated areas.

Compressed gas cylinders are stored in 4 concrete bins on the rear loading dock. The gasses include hydrogen, argon and oxygen. Approximately 6 standard cylinders of each are stored at this location. An acid storage building (building 9959-3) is located adjacent to the loading dock. The acid storage building is a freestanding metal 8-ft X 8-ft building. A gasoline powered generator and the primary building electrical feeder station are located in a detached concrete building (building 9767-9) southeast of the loading dock. An oil filled transformer is located south of the electrical substation.

Natural gas, argon, and nitrogen are piped into the laboratories from a pipe rack south of building 9203. The manual shut off valves are located outside the building's southwest corner. The natural gas system is not in-service, and the system valves are locked in the closed position.

Building 9752 - This small building is an electrical maintenance shop that contains testing equipment and soldering instruments, in addition to a machine equipment room and work shop. The primary fire hazards here are small containers of lubricants and cutting oils, shop manuals on open book shelves, and the electrical soldering guns.

Building 9205 - This building is used as the Chemical Vapor Processing Laboratory. A small area in the front is used as a workshop by building maintenance personnel. The laboratory has two vented test chambers, which use hydrogen gas. The excess gas is vented to the outside. The laboratory area contains cylinders of hydrogen, chlorine, methane, and ammonia. The electrical equipment in this building is not classified equipment. Because of the presence of cylinders of compressed gases inside the building, this is considered a high hazard area.

4.2 Runoff/Containment of Fluids

Runoff from sprinkler flow or from fire fighting operations would likely drain out of the building and towards the south, due to the existing slope at this location. A system of storm drains is installed at the plant site. Emergency response personnel initiate procedures to minimize potential fluid runoff during fire emergencies. In the unlikely event that the sprinkler system were to operate for an extended period, or if fire fighting operations continued for an extended duration, the runoff would enter the storm drain system.

5.0 FIRE PROTECTION

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5.1 Water Supply and Distribution System

The complex is supplied by the plant combined domestic, industrial, and fire service water supply and distribution system. Two water supply gravity reservoirs having a 7 million gallon water reserve and treatment system are located on the north side of the plant. This system provides water to the Y-12 Plant, Oak Ridge National Laboratory, and the City of Oak Ridge. An additional 6 million gallon reserve supply is provided by three storage tanks (each tank has 2 million gallon capacity) on the south ridge of the plant. This 6 million gallon gravity reserve is dedicated solely to fire protection for the Y-12 Plant. Several feed mains (twenty four inch and sixteen inch diameter) from the water treatment plant to the grid distribution system are provided. In the section of the plant where the 9203 building complex is located, the feeds consist of two 16 inch lines and two ten inch lines. The main feeds connect to an eight inch diameter loop around Building 9203. Three hydrants serve the Building 9203 complex. Hydrant 213 is on the eight inch line in front of the building along First Street. Hydrant 212 is also on the eight inch loop on the east side of the building. Hydrant 205 is supplied from an eight inch line and is located southwest of the building, inside the security fence. The main sprinkler feed to building 9723-24 and building 9203 are six inch diameter lines taken from the eight inch loop. The sprinkler systems are all connected through PIVs located in the yard. The sprinkler feed to building 9205 is a three inch diameter feed extended from building 9203.

Flow tests performed on the water distribution system in the vicinity of building 9203 in September 1992 showed excellent flows and pressures. Hydrant 214, located along First Street, north of building 9202 provided a static pressure of 76 psi. With a flow of 3770 gpm, a residual pressure of 62 psi was observed at Hydrant 214. Hydrant 208, located northeast of building 9201-3, provided a static pressure of 90 psi. With a flow of 3912 gpm, a residual pressure of 78 psi was observed at Hydrant 208.

The current yard main system to building 9203 is considered to provide an adequate and reliable water supply and distribution system for any potential fire protection needs, and satisfies the criteria of DOE Orders.

5.2 Fire Suppression

The Building 9203 and 9203A Complex is completely sprinkler protected. The coverage of the building is split into two systems: building 9203A and building 9723-24 are protected by one system, and building 9203, building 9752, and building 9205 are protected by the second system. The rear loading dock is protected by a two inch dry pipe valve, manufactured by Grinnell. The main valve is connected to the sprinkler system for building 9203, while the front walkway areas of building 9723-24 and building 9752 are protected by anti-freeze loops. The sprinkler systems were installed at different times and with differing types of valve trim and sprinklers.

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The wet pipe sprinkler system protecting building 9723-24 and building 9203A is fed from a six inch connection to the yard main on First Street. The sprinkler riser is located in the lunch room area in the north section of building 9723-24. A Tyden six inch alarm check valve is installed on the riser above the system OS&Y valve. A corresponding PIV in the yard outside the building is provided with a tamper switch, and is locked in the open position. Waterflow is indicated by a water motor gong and a pressure switch located above the retard chamber. The water flow alarm is electrically connected to the Gamewell fire alarm system. Tamper indication is provided by stem mounted tamper switches on the control valves. A fire department siamese connection is located on the north wall of the building at this location. Spare sprinklers for building 9723-24 are marked Viking Model C 1953, 165 °F. Observation of exposed sprinkler piping showed that the system is a pipe schedule system designed for Ordinary hazard. Spacing is approximately 115 square feet per sprinkler. Where suspended ceilings are installed, there are sprinklers both above and below the ceiling. The system installed in building 9203A is similar, however, newer style sprinklers are installed. There are two raised floor computer rooms in building 9203A. These areas are in rooms 212 and 215 on the second floor. Additional branch lines are located beneath the raised floor areas in these rooms. A shutoff valve for room 212 is located at the ceiling level in the corridor just outside the room.

The wet pipe sprinkler system protecting building 9203, building 9752 and building 9205 is fed from a six inch connection to the yard main on the east side of the building. The sprinkler riser is located in room 26 on the east side of building 9203. An Automatic Sprinkler Company six inch alarm check valve is installed on the riser. A PIV locked in the open position is provided in the yard outside the building to isolate the system. Waterflow is indicated by a water motor gong and a pressure switch. The water flow alarm is connected to the Gamewell fire alarm system. A fire department siamese connection is located on the east wall of the building at this location. The sprinkler system is designed and installed to Ordinary hazard requirements. Where suspended ceilings are installed, there are sprinklers both above and below the ceiling.

The automatic sprinkler systems in Building 9203 and 9203A Complex, in general, conform to NFPA 13, Standard for the Installation of Automatic Sprinkler Systems, and are considered adequate for the hazards present in these buildings. Some minor concerns were identified, that have a limited impact on the overall effectiveness of the systems. These deficiencies are listed in Section 9.2 of this report.

No standpipe systems are installed in any buildings in this complex. Interior fire attack will be performed by fire department hose evolutions. The multiple exterior doors allow the fire department to attack a fire from different directions in the event one of the doors is obstructed by the fire. A 200 foot hose lay is capable of reaching all areas in these buildings. NFPA 101 does not specify a standpipe system for a two story Business/Industrial Occupancy. The present arrangement is considered to provide an acceptable level of protection.

Multipurpose dry chemical fire extinguishers, having 2A-10BC ratings, are installed throughout

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the corridor areas of the Building 9203 and 9203A Complex. The extinguishers are spaced at about 75 foot intervals. Additional units are located in some of the various laboratories and shop areas. CO₂ units, having 20 lbs. of agent, and 2-1/2 gallon pump type water units are provided in each computer room in accordance with DOE/EP-0108. Larger multipurpose dry chemical fire extinguishers, having 20A-120BC ratings, are located in areas where pressurized hydraulic lines or other combustible liquids could be encountered. These areas include the Vacuum Technology Laboratory and the Stress Fracture Testing Laboratory. A container of Class D (Coke) extinguishing agent is located in room 8 for use on combustible metal fires. Building 9205 is provided with 20 lb CO₂ units and cartridge operated dry chemical extinguishers.

The portable fire extinguishers in the Building 9203 and 9203A Complex have current inspection tags, are spaced within the 75 foot travel distance limitation of NFPA 10, and provide the area coverage specified in Table 3-2.1 of NFPA 10. Specialized extinguishers are located in areas requiring protection of particular hazards. The fire extinguishers are adequate for the first aid fire fighting needs of the occupants of the buildings, and conform to the requirements listed in NFPA 10, Portable Fire Extinguishers.

5.3 Protective Signaling Systems

The Building 9203 and 9203A Complex is connected to the plant Gamewell fire alarm system. The plant wide system connects all of the facilities to a central monitoring station located in building 9710-2 and to the Plant Shift Superintendent's office in building 9706-2. The building evacuation signals are announced over PA system speakers installed throughout the corridors. All personnel alerting signals are announced over the plant PA system from the Plant Shift Superintendent's control center. This includes all site emergencies such as severe weather, weather, radiation incidents, fires, etc. The PA system is installed in each building, as well as in the yard areas, and is routinely tested. Any actuated manual pull station or water flow alarm will automatically be transmitted to the site fire department. The fire department will respond with a full assignment consisting of an incident command vehicle, ambulance, an aerial ladder/pumper combination, and rescue vehicle. Standard operating procedures are to respond to the master box that is in alarm and then determine the location of the event from the annunciator panels located by each master box. The building is connected to master box #215 located at C Road and First Street just west of Building 9202. The alarm system includes eight manual pull stations, waterflow and tamper alarms, and duct smoke detectors for the Laser Lab in Room 19.

Two local control panels are located in the complex. A Pyrotronics System 3 control panel is mounted in the second floor corridor of Building 9203A. This panel is used to monitor the smoke detectors in computer rooms 212 and 215. The smoke detectors in these rooms are located below the raised floor and on the ceiling. The other control panel is mounted in the middle corridor of Building 9203. This panel is a Gamewell Zans 400 model that is used to monitor the duct detectors installed in room 19. The control panels are connected to the plant

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wide fire alarm system. The above mentioned detectors are the only detection devices in this complex.

One deficiency was identified in this area. The Gamewell Zans 400 fire alarm control unit on the 1st floor in the corridor at col. 6-G lacks appropriate alarm zone identification. This information should be listed at the control panel.

The March, 1993 FHA listed a deficiency in this building for a lack of duct smoke detectors. The present condition of the fire alarm system does not satisfy the requirements of DOE Order 5480.7A. The HVAC system in the building is a recirculating type system. In a fire event, smoke and toxic gases, and possibly contaminated materials will be recirculated throughout the occupied areas. The duct smoke detectors are intended to shutdown the HVAC fans which will in turn limit the spread of smoke.

5.4 Adequacy of Protection

The Building 9203 and 9203A complex consists of laboratories, industrial occupancies, and office space. The laboratories, with small quantities of flammable and combustible chemicals, and the hydraulic testing equipment in the Stress Fracture Testing Laboratory represent the greatest potential fire hazards in the complex. Additional concerns were identified for the use of highly flammable compressed gases in Building 9205. The complex is fully sprinkler protected, and has an adequate number of remotely located exits provided for the occupants. The plant fire department has ready access to the building, and the water supply at that location is excellent.

The FHA for this complex has identified two deficiencies with regard to the fire protection systems provided in this complex. The fire alarm system has no provisions to stop the HVAC system upon the detection of smoke. A recommendation to install duct smoke detectors in all of the air handler units was made to correct this deficiency. The use and storage of flammable compressed gases in Building 9205 was identified as a specialized hazard requiring additional protection to minimize the level of risk. It was recommended that either the gas cylinders be kept outside of the building, or a flammable gas detection system should be installed.

With the exception of these two deficiencies, the level of fire protection for this complex is considered adequate.

5.5 Fire Department/Fire Brigade Response

Reference (a) verifies that the Y-12 Plant Fire Department is trained and equipped to handle any fire that could occur in a building the size of the Building 9203 and 9203A complex.

5.5.1 Pre-fire Plans

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The Y-12 Plant Fire Department has prepared pre-fire plans for building 9203 and building 9203A. The incident command vehicle of the fire department carries a set of pre-fire plans for the plant, including the above mentioned plans. Additional sets of pre-fire plans are located at the fire department, building 9710-2, and the PSS office, building 9706-2.

The plans are comprehensive in nature and have suitable information for fire ground operations. However, the pre-fire plans lack sufficient information on high dollar value equipment, critical process equipment, locations of HVAC system controls and shut-offs, and potential salvage operations. Revised pre-fire plans should be prepared to include this information.

5.5.2 Apparatus Access to Facility

Based upon a review of the Y-12 Plant Fire Department response records over the last 12 months, the response time for the Y-12 Plant Fire Department to respond to the Building 9203 and 9230A Complex is less than 2 minutes from receipt of the alarm or call. The distance from the fire station to the complex is less than 1/2 mile. The Building 9203 and 9203A Complex is accessible by the fire department on the north, east, and south sides of the complex. The west side of the complex has a 7 ft. high security fence, which separates the complex from the limited area of the plant. This security fence is provided with locked gates to provide fire department access to the buildings from the west side during emergency conditions.

5.6 Facility Fire Training

There is no fire brigade for this building.

Employee training in fire protection consists of portable fire extinguisher training, hazard recognition, and fire alarm reporting.

6.0 FACILITY EQUIPMENT AND PROGRAM PRESERVATION

6.1 Protection of Essential Safety Class Systems

No essential class safety systems are contained in these buildings. The nature of the experiments conducted may involve small quantities of fissile materials; however, there are no systems in the buildings that require management during a fire event to preclude reaching an unrecoverable condition.

6.2 Critical and Vital Programs

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6.2.1 Identification of Vital Programs Impacted and Recovery Potential

A deficiency was identified with the building pre-fire plans, because they do not contain any information about the need for prompt salvage actions, nor do they identify the location of the high dollar equipment that needs to be protected. The personnel in these areas indicated that all of this equipment is 20 years old or older, and would most likely be replaced rather than be repaired.

6.2.2 Identification and Protection of Critical Process Equipment.

The following equipment has been identified as being critical to the mission of this building complex:

Building 9203 -

- 1) Stress fracture test stands in room 1.
- 2) X-ray equipment in room 17
- 3) Two laser units in room 19
- 4) Transmission electron microscopes in rooms 45 and 46.
- 5) Scanning electron microscope in room 48
- 6) Scanning auger microscope and secondary ion microscope in the SIMS laboratory

All of this equipment is located in areas having area wide automatic sprinkler protection. Room 19 also has duct smoke detectors to stop the HVAC supply fans upon the detection of smoke.

Building 9203A -

- 1) Non destructive X-ray test equipment in room 104 and its control equipment in room 102.
- 2) Ultrasonic test equipment in room 105.

All of this equipment is located in areas having area wide automatic sprinkler protection.

Building 9205 -

No critical process equipment

Building 9723-24 -

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No critical process equipment

Building 9752 -

No critical process equipment

6.3 Identification and Protection of High Dollar Value Equipment

The following equipment has been identified as having a replacement cost over \$250,000.

Building 9203 -

- 1) Stress fracture test stands in room 1 \$500,000
- 2) X-Ray equipment in room 17 \$600,000
- 3) Two laser units in room 19 \$400,000
- 4) Transmission electron microscope in room 45 \$500,000
- 5) Scanning electron microscope in room 48 \$350,000
- 6) Scanning auger microscope (cols. 8-9 & A-B) in the SIMS Laboratory \$600,000
- 7) Secondary ion microscopes (cols. 9-11 & A-B) in the SIMS Laboratory \$1,000,000

All of this equipment is located in areas having area wide automatic sprinkler protection. Room 19 also has duct smoke detectors to stop the HVAC supply fans upon the detection of smoke.

Building 9203A -

- 1) Non destructive X-ray test equipment in room 104 and its control equipment in room 102. \$600,000
- 2) Ultrasonic test equipment in room 105. \$1,000,000
- 3) Computer equipment in rooms 212 and 215. \$300,000

All of this equipment is located in areas having area wide automatic sprinkler protection. Computer rooms 212 and 215 are also protected by area wide smoke detectors located on the ceiling and below the raised floor.

Building 9205 -

No high dollar equipment

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Building 9723-24 -

No high dollar equipment.

Building 9752 -

No high dollar equipment

6.4 Facility Damage Potential

6.4.1 Maximum Credible Fire Loss

The MCFL for this complex is predicted for a fire in the ultrasonic testing area, room 105 in Building 9203A. Per the definition of MCFL, the automatic fire protection systems are assumed to function, however, no manual fire fighting activities occur. The estimated value of the equipment in this room is in excess of \$1,000,000. The downtime for the facility and potential loss of proprietary computer software related to the test facility could increase this estimate. High dollar value equipment is located in several areas of the complex, however, in all other cases the highest dollar loss in a single room is under \$750,000. Because of the non-combustible construction of the facility and the installed automatic sprinklers, fire is not expected to extend beyond the room of origin in any area containing high dollar value equipment. With the present HVAC system, the spread of smoke and products of combustion will occur in the corridors and adjacent rooms. This will increase the total fire loss. The MCFL considering this is estimated to be \$1,500,000.

6.4.2 Maximum Possible Fire Loss

The MPFL for this building complex is predicted to be an uncontrolled fire occurring in the southwest corner of Building 9203. The equipment in the micro analysis lab and the X-ray diffraction lab is valued at a total of \$850,000. The uncontrolled fire is predicted to generate sufficient amounts of smoke and products of combustion to damage all of this equipment, the contents of the building, and to cause localized structural damage. Due to the design of the HVAC system, surrounding areas will also be subject to this damage. Because of the lack of qualified penetration seals and other issues identified with the fire barriers in this complex, the fire damage will not be contained to just this building. However, the limited amount of hazardous and radioactive material is not likely to cause contamination beyond the building boundaries. Considering this possible extent of damage, the MPFL is estimated to be \$7,000,000.

6.5 Security Coordination

The fire department responds to fire emergencies at the Building 9203 and 9203A Complex from

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the protected area of the plant. Standard operating procedures are in place to assure that the emergency response through security gates is not delayed exiting the protected area.

With regard to fire fighting evolutions for building 9203, Hydrant 205, which is located southwest of the complex, is inside of the limited zone fence. Hydrants 212 and 213 are available to the fire department from locations outside of the fence. If these two hydrants could not supply sufficient fire flow and Hydrant 205 was needed, security will need to open the normally locked security gate adjacent to the hydrant. It is not expected that this situation would ever occur. Recent tests show that both of the hydrants outside the fence are capable of flowing in excess of 3,000 gpm. The fire department siamese connections for the two sprinkler zones in the building are located convenient to these two hydrants.

7.0 PROGRAM DOCUMENTATION

7.1 Currency and Completeness of FHA

The Fire Hazards Analysis for this building is dated March 1993. The FHA is complete and accurately represents the hazards present in this building. The FHA concludes that the Building 9203 and 9203A Complex has three major fire protection deficiencies. The FHA is acceptable in its present form.

7.2 Previous Facility Appraisal Reports

A Facility Appraisal Report was performed for Building 9203 in April 1990 by the plant Fire Protection Engineering group. The contents of the report covered the fire hazards, potential risks, life safety, and fire protection features of the facility.

7.3 Review of Temporary Protection and Interim Compensatory Measures

No interim compensatory measures are in place or necessary for this building.

7.4 Status of Findings From Previous Assessments

Findings are from previous building assessments. These previous findings and their current status are listed below:

Building 9203

7.4.1 Sprinkler are lacking under the wide ducts in Room 8, Column Line B-11/12.

Status: OPEN

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Building 9203A: First Floor

7.4.2 Stairwell at Column Lines Z-13 is provided with one sprinkler head below roof at top of stair tower. Sprinkler heads are lacking at other floor levels.

Status: OPEN

7.4.3 A sprinkler branch line with sprinkler heads is lacking in X-Ray Room 104, column Lines Y/Z-14 1/2.

Status: OPEN

Building 9203A: Second Floor

7.4.4 Conference Room lacks sprinkler head in projection booth, Column Lines A/B-6.

Status: OPEN

7.4.5 Smoke detectors are not provided in Computer Rooms 212 and 215.

Status: CLOSED

Building 9205

None.

Building 9723-24

7.4.6 Exit access aisle at Column Lines F-9 1/2/10 1/2 is reduced to 36 inches by location of HVAC unit.

Status: CLOSED

7.4.7 Lunch room bounded by Column Lines E/G-6/11 containing seating for more than 50 persons lacks illuminated exit signs over each of the two exit doors. West door requires red color

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on the east side of door.

Status: CLOSED

7.4.8 Locker room bounded by Column Lines X/Z-1/7 contains lockers and associated facilities for more than 50 persons. This room lacks illuminated exit signs over doors at Column Lines Y/Z-6 and Z-1; Lacks illuminated exit signs with arrow pointing south on the east side of the wall, Column Lines Y/Z-1; and lacks illuminated exit sign with arrow pointing north and south on the west side of wall at Column Lines C-6.

Status: CLOSED This area of the building has been renovated. Lockers and associated facilities have been removed from the building.

Building 9752

7.4.9 Sprinkler head is lacking under wide duct in Equipment Room 13A.

Status: OPEN

7.4.10 Room 12 is the only location in the facility in which foamed plastic drop out ceiling panels are used. These are in a deteriorated state and require replacement with mineral fiber panels which are provided in the newly pendant type sprinkler heads.

Status: OPEN

7.4.11 Fire Extinguishers have not been provided in the newly renovated laboratory and office area approximately bounded by Column Lines C/H-9 1/2/10.

Status: CLOSED

7.5 Evaluation of Administrative Controls

Building fire inspections are performed by the Y-12 Fire Department on a monthly schedule per department procedures. Hot work in the building is controlled by the plant's welding and burning procedures. In the event of outage of the fire alarm system and detection system in the building, compensatory measures are implemented. Quantities of flammable and combustible liquids introduced into the building are also controlled by plant level procedures. The administrative controls, which are further described in reference (a), are considered adequate for this facility.

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7.6 Documentation of Exemptions and Equivalencies

There are no exemptions or equivalencies on record for this building.

8.0 OPERATIONS AND MAINTENANCE

8.1 Review and Evaluation of Procedures for Inspection, Maintenance, and Testing

Inspections and tests of the office building fire protection features are performed by the fire department personnel on a scheduled basis. Functional tests are conducted on the smoke detectors, manual pull stations, and master box #215. Hydrant flow tests are performed annually. Tests results are analyzed using hydraulic gradients to assess water main degradation, and results are compared to previous flow test data. Some records and results of the tests were checked and found to be adequate.

The building 9203-9203A complex has adequate testing and maintenance provisions to ensure that the building is fire safe for the occupants. Site provisions for inspection, testing, and maintenance of fire protection equipment described in reference (a) are acceptable.

8.2 Review and Evaluation of Corrective Actions and Work Order Priority

Life safety and fire protection deficiencies are given top priority for corrective action at the Y-12 Plant. Corrective actions are performed in a timely manner for life safety related findings.

8.3 Fire Protection Engineering Staffing

One fire protection engineer from the plant's Fire Protection Engineering group provides engineering services to building 9203 and the adjacent facilities in this plant area.

8.4 Facility Management Support of Fire Protection Program

The facility management responsible for building 9203 has supported the fire protection program by correcting identified deficiencies within the building.

9.0 SUMMARY OF IDENTIFIED DEFICIENCIES

9.1 Deficiencies Related to DOE Orders

9.1.1 The Building 9203 and 9203A Complex lacks a comprehensive fire barrier maintenance program, as required by DOE Order 5480.7A ¶ 9.b. (2) and (5).

Recommendation 11.1

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Deficiencies were noted with all of the fire barriers during the field survey of the complex. The rear stairway of building 9203A has numerous penetrations through the protected exit enclosure. The penetrations include conduits, cable trays and a duct that is approximately 3 feet by 4 feet in dimension. NFPA 101 specifies that exit enclosures must not be penetrated except for sprinkler piping, stair pressurization, or conduits for lighting within the exit.

The concrete block wall that separates Building 9723-24 from Building 9203 has numerous open penetrations for conduits and computer cables that have not been properly sealed.

The south wall of the Vacuum Technology Laboratory includes a section of approximately 300 square feet of glass block. The glass block has been painted to resemble the adjacent concrete blocks. The glass wall will not provide a two hour fire rating.

The wall between Building 9203 and Building 9752 is a hollow clay tile barrier. The door in this wall has an ordinary glass vision panel, approximately 10-in X 10-in. The ordinary glass will not provide the required fire rating.

The corridor doors to the computer rooms (212 and 215) on the second floor of Building 9203A have large vision panels and ventilation louvers in their lower half. Per NFPA 75, computer rooms should be separated from adjacent areas by one hour fire rated construction.

9.1.2 The HVAC systems lack duct mounted smoke detectors to de-energize the supply fans to prevent recirculation of fire by-products. This special hazard protection is required by DOE Order 5480.7A ¶ 9.B. (12). Recommendation 11.2

At least, fifteen separate HVAC systems are installed in the complex. The HVAC fans can only be stopped by deactivating the circuit breaker for the power supply. The breakers are typically located in the fan rooms which are mainly on the roof. The majority of the systems are recirculating type systems that use the corridors for a return plenum. In a laboratory fire situation, the exit corridors will be subject to smoke and possibly toxic or contaminated products of combustion. Duct mounted smoke detectors should, therefore, be installed in all of the recirculating systems in accordance with NFPA 90A to automatically stop the fans upon detection of smoke.

9.1.3 In building 9205, leakage of flammable gases from the hydrogen, methane, and ammonia gas cylinders used in the chemical vapor process presents a potential hazardous fire situation. This special hazard protection is required by DOE Order 5480.7A ¶ 9.B. (13). Recommendation 11.3

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The flammable gas cylinders should be relocated external to the building or flammable gas detection provided in the building and connected to the plant fire alarm system.

9.1.4 The pre-fire plans for Building 9203 and 9203A Complex lack sufficient information on high dollar value equipment, critical process equipment, HVAC system controls and shut-offs, and potential salvage operations. DOE Order 5480.7A ¶ 9.A. (2). Recommendation 11.4

While the pre-fire plans contain adequate information for fire fighting, they do not have any indication of the locations of high dollar equipment, and pre-planned salvage actions that are needed to prevent damage to this sensitive electronic equipment. If the sprinkler system is not shut off promptly, or if manual fire streams are not judiciously directed, the property loss in a fire could be greater than necessary. The HVAC system controls are located in different HVAC rooms in the complex and on the roof. Because the HVAC systems recirculate the air in the complex, the fire department should know where the shut offs are located to prevent the recirculation of toxic or contaminated by products.

9.2 Deficiencies Related to NFPA Standards

Building 9203A and 9723-24

9.2.1 Intermediate temperature rated sprinklers (212 °F) are installed throughout most of the second floor of building 9203A instead of Ordinary temperature rated sprinklers. NFPA 13 ¶ 4-3.1.3.1. Recommendation 11.5

9.2.2 The sprinklers installed in the boiler room in the southeast corner of building 9723-24 have upright heads that have been installed in the pendent position. NFPA 13 ¶ 4-3.1.1. Recommendation 11.6

9.2.3 The raised floor areas in the computer rooms are 18-21 inches above the floor. The sprinklers installed in these spaces are located at the lower floor level. NFPA 13 ¶ 4-4.1.4.1. Recommendation 11.7

9.2.4 Two sprinklers are located within 5 feet of each other in the entrance corridor of building 9723-24 by the entrance to the lunch room. NFPA 13 ¶ 4-4.1.7.1. Recommendation 11.8

9.2.5 The sprinkler in the custodian's closet on the second floor of building 9203A is located for use with a suspended ceiling. There is currently no ceiling in place at this location. NFPA 13 ¶

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4-4.1.4.1. Recommendation 11.9

9.2.6 The rear exit doors from the large Assembly area in the front of building 9723-24 swing against the direction of exit travel. NFPA 101 ¶ 5-2.1.4.1. Recommendation 11.10

Buildings 9203 and 9752

9.2.7 High temperature sprinklers (286 °F) are installed in room 11, instead of ordinary temperature rated sprinklers. NFPA 13 ¶ 4-3.1.3.1. Recommendation 11.11

9.2.8 A 4 foot wide duct is located near the ceiling on the south side of the Vacuum Development laboratory, room 150. Several heads are provided beneath the duct, however, the coverage does not extend the length of the duct. NFPA 13 ¶ 4-4.1.3.2.1. Recommendation 11.12

9.2.9 An upright sprinkler head in the rear of room 17 has been installed in the pendent position. NFPA 13 ¶ 4-3.1.1. Recommendation 11.13

9.2.10 The dry pipe valve for the rear loading dock lacks a pressure switch for water flow indication. NFPA 13 ¶ 4-7.1.1.1. Recommendation 11.14

9.2.11 The thorium and radioactive sources are not stored in an area that has a one pass ventilation system, such as rooms 19 and 42. NFPA 45 ¶ 6-4.2. Recommendation 11.15

9.2.12 The fire alarm control unit on the 1st floor in the corridor at col. 6-G lacks appropriate alarm zone identification. NFPA 72¶ 1-5.7.1. Recommendation 11.16

Building 9205

9.2.13 In building 9205, the west HVAC room lacks a water supply to the installed automatic sprinkler system. NFPA 13 ¶ 7-1. Recommendation 11.17

9.3 Deficiencies Related to Other Codes

No deficiencies related to UBC or other codes were identified.

9.4 Other Deviations From Good Practice

No deviations from good practice were identified.

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10.0 CONCLUSIONS

Four violations of DOE Orders were identified for this building. Several other deficiencies were identified that need to be corrected to enable compliance with the applicable NFPA Codes. Because of the use of flammable and combustible chemicals and compressed gases in this complex, an unacceptable level of risk exists until the identified deficiencies are corrected.

11.0 NEW RECOMMENDATIONS

(See section 7.4 for previous recommendations.)

11.1 Develop a building wide fire barrier inspection and maintenance program. This program should periodically evaluate the condition of all required fire barriers and ensure that rated barriers are provided where required. Open penetrations caused by the routing of computer cables and other services should be routinely sealed with approved materials. Section 2.2

11.2 Install duct mounted smoke detectors on all air handlers in accordance with NFPA 90A. Arrange the detectors to stop the HVAC fans upon the detection of smoke. Section 5.3

11.3 Relocate the flammable compressed gas cylinders in Building 9205 outside the building or install a flammable gas detection system in the building. Section 4.1

11.4 Revise the pre-fire plans for Building 9203 and 9203A Complex to include detailed information on high dollar value equipment, critical process equipment, locations of HVAC system controls and shut-offs, and potential salvage operations. Section 5.4.1

11.5 Install Ordinary temperature sprinkler heads throughout the second floor of building 9203A. Section 5.2.1

11.6 The sprinklers installed in the boiler room in the southeast corner of building 9723-24 have upright heads that have been installed in the pendent position. Either replace the upright heads with pendent heads, or install the sprinklers in the upright position. Section 5.2.1.

11.7 The raised floor areas in the computer rooms in building 9203A are 18-21 inches above the floor. The sprinklers installed in these spaces are located at the lower floor level. Raise the sprinkler heads to the underside of the raised floor. Section 5.2.1.

11.8 Two sprinklers are located within 5 feet of each other in the entrance corridor of building 9723-24 by the entrance to the lunch room. Either separate the two heads by a distance of six feet, or install a spray baffle. Section 5.2.1.

11.9 The sprinkler in the custodian's closet on the second floor of building 9203A is located for

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use with a suspended ceiling. There is currently no ceiling in place at this location. Replace the suspended ceiling tiles in the closet. Section 5.2.1.

11.10 Reverse the direction of swing for the double doors providing the second means of egress from the large Assembly area on the first floor of building 9723-24.

11.11 Install ordinary temperature rated sprinklers in room 11 of building 9203. Section 5.2.1.

11.12 Install lower tier sprinkler heads beneath the 4 foot wide duct located near the ceiling on the south side of the Vacuum Development laboratory, room 150 in building 9203. Section 5.2.1.

11.13 An upright sprinkler head in the rear of room 17 has been installed in the pendent position. Replace the sprinkler with a pendent head. Section 5.2.1.

11.14 Install a pressure switch connected to the building fire alarm panel for water flow indication on the dry pipe valve for the rear loading dock of building 9203. Section 5.2.1.

11.15 Store the thorium and radioactive sources in an area that has a one pass ventilation system, such as rooms 19 and 42. Section 4.1

11.16 Provide appropriate alarm zone identification for the fire alarm control unit on the 1st floor in the corridor at col. 6-G in building 9203. Section 5.3.1

11.17 Connect the automatic sprinkler system in building 9205, protecting the west HVAC room to a qualified water supply. Section 5.2.1

12.0 REFERENCES

- (a) "Site-Wide Fire Protection Features", Y-12 Plant, Y/XP-198, dated February 10, 1992
- (b) Fire Hazards Analysis for the Building 9203 and 9203A complex, dated March 1993
- (c) Y-12 Plant Emergency Plan dated July, 1992

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APPENDIX A

BUILDING 9203/9203A FLOOR PLANS AND SITE PLAN

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APPENDIX B

QUALIFICATIONS OF AUTHORS

Randall Eberly: B.S. degree in Fire Protection Engineering from the University of Maryland; Registered Professional Fire Protection Engineer; 21 years experience in fire protection engineering as a private consultant and as an employee of the Nuclear Regulatory Commission, U.S. Coast Guard, Tenera, and Events Analysis, Inc.

Robert O'Laughlin: B.S. degree in Fire Protection Engineering from the University of Maryland; Registered Professional Fire Protection Engineer; Certified Safety Professional; 32 years experience in fire protection engineering as a private expert and as an employee of the National Institute of Standards and Technology, Professional Loss Control, Union Carbide, and the Tennessee Valley Authority.

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ANNEX #1 AUGUST 2, 1995

A re-assessment of the Building 9203 and 9203A Complex was conducted in July and August 1995. Generally, the construction, occupancy, and use of the building have not changed except for the items listed below.

The conditions identified in this assessment that vary from the Baseline Assessment are the following:

Construction:

In building 9203, a noncombustible suspended ceiling was installed below the piping and ventilation ducts in the corridors. Sprinklers have been installed below the suspended ceiling.

In building 9723-24, a new partition was added in the Class "C" place of assembly with double leaf swinging doors that open in the direction of exit travel.

Fire Hazards:

In building 9203, the glove boxes containing the lithium hydride have been re-located from rooms 7 and 8 to room 42.

In room 13 in building 9203, an Adept robotics machine has been installed in the northwest corner of the room to be used as a de-burring tool machine for Sandia Lab. The value of the machine and computer equipment is approximately \$500,000. Currently, the machine is not operational.

In building 9205, the hydrogen gas cylinders and the ammonium gas cylinders have been removed from the building. This eliminates a significant fire hazard and re-classifies this occupancy from "High Hazard" to "Ordinary Hazard". The removal of the flammable gases from building 9205 corrects a deficiency identified in the Fire Hazards Analysis. The FHA should be revised accordingly.

Life Safety:

New exit signs and directional exit signs have been installed in the 9203 and 9203A Complex.

In building 9723-24, the double leaf door from the Class "C" place of assembly has been reversed. Reversing the door swing for the place of assembly in building 9723-24, corrects a deficiency identified in the March 1993 facility assessment.

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Status of Findings from Assessments Prior to March, 1993:

All open findings from previous assessments noted in section 7.4 of the March 1993 Baseline Fire Protection Facility Assessment remain open. These previous findings are identified along with their current status.

Status of Deficiencies in March 1993 Baseline Fire Protection Facility Assessment:

The following deficiencies from the March 1993 Fire Protection Facility Assessment have been corrected:

Building 9732-24

9.2.6 The rear exit doors from the large Assembly area in the front of building 9723-24 swing against the direction of exit travel.

Status: COMPLETE - The exit doors have been modified to swing with the direction of exit travel.

Building 9205

9.1.3 In building 9205, leakage of flammable gases from the hydrogen, methane, and ammonia gas cylinders used in the chemical vapor process presents a potential hazardous fire situation. This special hazard protection is required by DOE Order 5480.7A ¶ 9.b. (13)

Status: CLOSED - The flammable gases have been removed from the building. The chemical vapor process containing flammable gas cylinders in building 9205 is not operational.

9.2.13 In building 9205, the west HVAC room lacks a water supply to the installed automatic sprinkler system.

Status: COMPLETE - The sprinkler system piping in the west HVAC room has been re-connected to the sprinkler system in building 9205.

All other deficiencies identified in the March, 1993 report remain OPEN.